

DOCUMENT RESUME

ED 334 434

CE 058 496

AUTHOR Rolloff, John A.; Braker, Clifton R.
TITLE Developing and Disseminating a Tested Model Curriculum of Contemporary Farm Power and Equipment. Final Report.
INSTITUTION Arkansas Univ., Fayetteville. Dept. of Agricultural and Extension Education.
SPONS AGENCY Arkansas State Dept. of Education, Little Rock. Div. of Vocational and Technical Education.
PUB DATE Jul 88
NOTE 21p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Agricultural Education; *Agricultural Engineering; *Agricultural Machinery; Articulation (Education); *Competency Based Education; Criterion Referenced Tests; *Curriculum Development; Engines; *Instructional Materials; Postsecondary Education; Power Technology; Secondary Education; State Curriculum Guides; Technological Advancement
IDENTIFIERS Arkansas

ABSTRACT

Modern, innovative, and emerging technologies in farm power and equipment for secondary and postsecondary vocational agriculture programs were developed, field tested, and disseminated through a 3-year project in Arkansas. During the project, a needs assessment survey was sent to 272 vocational agriculture teachers in the state asking which areas of farm power and equipment they were teaching and the importance of each, as well as curriculum areas that were not being taught but should be. A nationwide search was then conducted for technologies and curricula. Based on the survey results, competency-based, criterion-referenced curriculum materials were developed for secondary programs and postsecondary programs; one curriculum covered the farm power portion of the subject matter, and the other the farm equipment topics. Materials were field tested, evaluated, and modified; and a competency-based, criterion-referenced curriculum guide was disseminated for statewide implementation. Within the first year after dissemination of the curriculum guides, there was a marked increase in the number of high schools offering a semester-long course in farm power and equipment. (Appendixes include the farm power and equipment curriculum content outline and curriculum evaluation forms.) (KC)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

~~AR88CD03~~
AR88CD03

019151

ED334434

FINAL REPORT

Developing and Disseminating a Tested Model Curriculum of Contemporary Farm Power and Equipment

Project Number: PI 86-05

Conducted By Co-Directors:

Dr. John A. Rolloff
Professor
Agricultural and Extension Education
University of Arkansas
Fayetteville, Arkansas

Dr. Clifton R. Braker
Professor
Agricultural and Extension Education
University of Arkansas
Fayetteville, Arkansas

* * *

In Cooperation With
Vocational and Technical Education Division
Arkansas Department of Education
Little Rock, Arkansas

Funded Under the Provisions of
Title II, Part B, of the Carl Perkins
Vocational Education Act

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

☒ This document has been reproduced as
received from the person or organization
originating it.

☐ Minor changes have been made to improve
reproduction quality.

• Points of view or opinions stated in this docu-
ment do not necessarily represent official
OERI position or policy.

July 1988

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

D. Walz

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

CE 057 496

INTRODUCTION

Production, processing, and distribution of agriculture food and fiber continues to utilize modern and emerging technologies in farm machinery design and operation. As a result, there is an ever increasing demand in the job market for vocational agriculture students with a background in the operation, repair, and maintenance of farm power and equipment. An examination of vocational agriculture programs in Arkansas indicated a near void in curricula for classroom and shop instruction covering farm power and equipment. The 14 areas of farm shop instruction previously taught to vocational agriculture students provided a base much like the 3 "R's" of general education. It was imperative that a curriculum be developed which more nearly represented the present and future needs of instruction in mechanized agriculture.

OBJECTIVES

The overall objective of the project was to develop, field test and disseminate curriculum guides covering current and projected advances in farm power and equipment. It was to be broad enough to cover all aspects of Arkansas' diverse agriculture, yet specific enough to be localized for individual department needs. The

specific project goals were: (a) Search for and evaluate potential utilization of new and emerging technologies and curricula in farm power and equipment to improve and expand vocational agriculture programs in Arkansas. (b) Develop competency based criterion referenced curriculum materials for secondary vocational agriculture programs and to extend those competency based tasks for use in post-secondary agriculture programs. (c) Field test and evaluate the developed curriculums in diverse secondary and post-secondary settings. (d) Disseminate, for statewide implementation, a competency based criterion referenced curriculum guide to improve and expand the scope and quality of instruction in farm power and equipment.

PROCEDURES

A needs assessment survey was sent to 272 Vocational Agriculture Instructors representing 233 secondary vocational agriculture departments in Arkansas. Subject matter covering farm power and equipment was divided into five basic areas of instruction. Each basic area was then subcategorized. Respondents were asked to indicate the areas of farm power and equipment instruction they were teaching and the perceived importance of each area as it would relate to their program. They were also asked to indicate any area in which they felt in-service training

would be needed should a curriculum be made available in that area.

Twenty three state departments of vocational education were contacted concerning the farm power and equipment curricula they were utilizing. Comprehensive responses were obtained from 8 states for review of content and style format. A comprehensive search of additional sources, such as publishing companies and manufactures of farm power and equipment, was conducted for pertinent literature and materials to be used as an informational and methodological base.

A review panel was formed to evaluate data from the needs assessment survey, and the other states curriculum. Members included educators from the University of Arkansas, College of Agriculture and Home Economics, State Supervisors of Vocational Agriculture in Arkansas, and representatives of the Arkansas Vocational Agriculture Teachers Association. Personnel from farm equipment dealerships were also included to increase the validation of the curricula.

Based on the panel's recommendations, a comprehensive curriculum content outline (Appendix A) was compiled. The outline and the data generated from multiple reference sources were then utilized in the development of the prototype curriculum. It soon became evident that the time and resources allocated in the original plan would be inadequate to complete the project. The scope and detail

of information deemed necessary by teachers and the review panel necessitated additional funds and an expanded time frame. Both addendum requests were granted. In addition, the curriculum was separated into two volumes at this stage. One curriculum covering the Farm Power portion of the subject matter and the other the Farm Equipment.

Ten secondary and four post secondary Arkansas Vocational Agriculture Departments were utilized as field test centers for the prototype curriculum guides. These centers were chosen and approved by the State Supervisor of Vocational Agriculture Education and the Deputy Director of Vocational and Technical Education respectively. The centers utilized the prototype curriculum in classroom and shop settings where feasible. Recommended revisions were offered by utilizers as a result of assessing the curriculum guides for content validity. The panel of experts then reviewed the two curriculums culminating in a prototype curriculum for each - one in Farm Power and the other in Farm Equipment.

RESULTS

The project has resulted with the development, printing, and dissemination of two competency based curriculum guides for use by instructors in teaching farm power and equipment courses. One covering the Farm Power portion of the subject matter and the other the Farm

Equipment. The Farm Equipment Curriculum guide also contains a section on farm machinery management which relates to both farm power and equipment. Both guides follow the style format adopted by the Mid America Vocational Curriculum Consortium. The 952 page Farm Power Curriculum Guide is divided into 28 individual subject units. The Farm Equipment Curriculum Guide is divided into 11 units and contains 452 pages. Each unit is complete with a unit objective sheet, an instructor guide which includes unit references and suggested activities to enhance instruction, and the subject matter or information sheets. Each unit also contains a set of transparency masters, written assignments in the form of assignment sheets and/or job sheets to direct students through hands on skill development. Test and test answers are also provided in each unit.

A copy of the Farm Power Curriculum Guide was disseminated to all vocational agriculture departments during the 1987 Summer Vocational Agriculture In-service workshop. The Farm Equipment Curriculum Guide is scheduled to be disseminated during the 1988 Summer Arkansas Vocational Conference. To date, four in-service workshops have been offered by the University of Arkansas, Agriculture and Extension Education Department covering the Farm Power Curriculum Guide. These workshops provided participants with familiarization of subject matter and use of the guides through demonstration and hands on activities.

EVALUATION

Evaluation has been constant throughout the duration of the project. Individual units, subject matter sections, and complete curriculum prototypes have been evaluated by instructors from the test centers and reviewed by panels of experts. Review conferences were held periodically during the development and testing phases of the project to assure user input and content validity. At the conclusion of the project, a questionnaire (Appendix B) was sent to each instructor of the schools that were utilized as test centers. A "likert" type assessment instrument was utilized to evaluate the final product. Instructors were asked to rate each component part of the guides, the ease of adaptability, usefulness to their program, and overall unit evaluation. A scale of one to ten was used, with ten being excellent. The mean score ratings for the Farm Power and the Farm Equipment Curriculum were 8.6 and 8.4 respectively. Using the same scale, the instructors were also asked indicate the extent to which the goals of the project had been meet. The first goal, which was to search for and evaluate potential utilization of new and emerging technologies and curricula in farm power and equipment to improve and expand vocational agriculture programs in Arkansas, had a mean score of 9.1. The second goal - to

develop competency based criterion referenced curriculum material for secondary vocational agriculture programs and to expand those competency based tasks for use in post secondary agriculture programs, received a mean score of 8.7. Goal three which dealt with field testing and evaluation of the developed curriculum in diverse secondary and post-secondary settings was rated 8.7. The final goal was to disseminate for statewide implementation a competency based criterion referenced curriculum guide to improve and expand the scope and quality of instruction in farm power and equipment. The final goal received a mean score of 8.9.

CONCLUSIONS AND RECOMMENDATIONS

It is evident from responses on the questionnaire that the goals and objectives have been met with strength. Acceptance of the curriculum guides by the vocational agriculture instructors across the state has been excellent. Within the first year after dissemination of the Farm Power Curriculum Guide, there has been a marked increase in the number of high schools offering a semester long farm power and equipment course. Those utilizing the Farm Power Curriculum Guide in actual classroom and shop settings have expressed strong feeling about it's usefulness to the success and improvement of their departments. Although they are pleased with the

instructor's curriculum guides and the result of this project, there remains some concerns. The project co-directors concur with them and together make the following prioritized recommendations.

1. The development of student curriculum guides to provide Arkansas students with a interrelated curriculum series attuned to modern and future agriculture power and equipment requirements. These guides should follow the same subject outline of the recently completed instructors guides in Farm Power and Equipment.
2. Vocational Agriculture Instructors in Arkansas should be exposed to the recently developed Farm Power and Equipment Instructor's Curriculum Guides through continued in-service work shops. It is recommended that participation be mandatory so all instructors can be made aware of modern and emerging technologies and their application to mechanized agriculture.
3. Funds be made available to assist local vocational agriculture departments with the cost of shop building renovation or construction and tool and equipment acquisition necessary to facilitate proper instruction of farm power and equipment courses.

APPENDICES

APPENDIX A

FARM POWER AND EQUIPMENT CURRICULUM CONTENT OUTLINE

A. Orientation and General Safety

Unit I Introduction and Job Opportunities

Importance of agricultural mechanics and its relation to agriculture. Description and information about job areas and skills needed.

Unit II General Safety

Emphasis on general shop safety, rules of shop conduct, fire safety, safety codes. Safety rules for working on large equipment.

B. Engines and Accessory Systems

Unit I History and Development

Basic understanding of the development of power machinery as we know it today. First gas, diesel, steam, and other engines. Development and importance of electrical, storage batteries and lubricating oils to engine development.

Unit II Principals of Engines

Fundamental operating principles of engines. Four-stroke, two-stroke, engine efficiency, identification and function of engine parts, types of engines.

Unit III Fundamentals of Power

Measurements of work, horsepower, efficiency, piston displacement, bore and stroke, compression ratio, atmospheric pressure.

Unit IV Principles of Combustion and Fuels

Gasoline fuel system, diesel fuel system, LP gas system, principles of combustion, principles of carburation, properties of fuels, air-fuel ratio. Service procedures and skills.

Unit V Intake and Exhaust Systems

Types of filters and principles, air supply systems, air cleaners and filters, exhaust systems, turbochargers, intercoolers, service procedures and skills.

Unit VI Lubrication Systems

Types of systems in engines, types of oil pumps, oil filters and functions, crankcase ventilation, kinds and properties of lubricating oils and greases, lubricity, viscosity, grades, service procedures and skills.

Unit VII Cooling Systems

Liquid cooling, air cooling, radiators, water pump, thermostats, fans, operating temperatures, antifreeze solutions, service procedures and skills.

Unit VIII Ignition and Electrical Systems

Ignition systems, batteries, magnetos, spark plugs, distributors, points, condensers, charging systems, timing, starters, lights and accessories, service procedures and skills.

Unit IX Governors

Principles and types of governors, adjustment and service, how to measure speed of an engine or a shaft on a machine, service procedures and skills.

Unit X Bearings and Seals

Function, types, and installation of bearings and seals, lubrication of, service procedures and skills.

C. Power Transfer Systems

Unit I Mechanical Power Trains

Discussion of clutches, transmissions, final drives, differentials, four-wheel drives, service procedures and skills.

Unit II Belt, Chain, and Shaft Drives

PTO, types of belts, chains and uses, shields and safety, lubrication of, determining size requirements of pulleys and shafts, adjustments, service procedures and skills.

Unit III Hydraulics

Principles of hydraulics, parts of hydraulic system and functions of each, types of pumps, hydraulic motors, control valves, maintaining the hydraulic system, types of hoses and connections, safety, service procedures and skills.

Unit IV Brakes

Types of brake systems, function of, service procedure and skills.

Unit V Steering Mechanisms

Power of steering, gear mechanisms, alignment, wheel bearings, service procedures and skills.

D. Farm Equipment Maintenance

Unit I Preventive Maintenance

Records, maintenance schedules, operators manual, reasons for, service procedures and skills.

Unit II Routine or Daily Maintenance

Records, pre-operation maintenance, field maintenance, safety maintenance.

Unit III Storage Maintenance

Procedures for short-term and long-term storage, advantages of proper storage procedures, operational procedures for removing from storage, repair schedules.

E. Farm Equipment Operation and Safety

Unit I Tractor Operation and Safety

Use of operators manual, control and operating instruments, tractor parts, symbols for controls, pre-operational checks, center of gravity, highway safety, SMV emblems, types of accidents.

Unit II Equipment Operation and Safety

Those topics pertaining to use of equipment, attaching equipment to power sources, adjustments, pre-operational checks, safety procedures, transportation, general discussion - specific areas will be covered in following units.

Unit III Tillage Equipment

Types of equipment, attachment to power sources, traction, flotation, soil compaction, field efficiency, safety. Types of plows - moldboard, disk, chisel, stubble mulch, tillers, subsoilers, harrows, cultivators. Tillage operations. Weed control equipment.

Unit IV Planting Equipment

Functions and types of planters, planter parts, repair and servicing, calibration and adjustments, machine capacities and efficiency, soil preparation.

Unit V Chemical Application Equipment

Includes fertilizers, herbicides, insecticides, and other agricultural chemicals. Granular and liquid chemicals, spreaders, sprayers, calibration of equipment, types of equipment, service procedures and skills and safety.

Unit VI Harvesting Equipment

Combines, cotton pickers, and other types of harvesting equipment. Functions of, service and repair of, selection of, determining capacity of, safety precautions.

Unit VII Hay and Forage Equipment

Types and sizes of equipment, operation and maintenance of, transport of, troubleshooting, safety procedures, timing and adjustments, harvesting systems.

Unit VIII Material Handling and Storage Equipment

Discussion of equipment involved in moving material, i.e., augers, hydraulic, and electric motors, air blowers, service procedures and skills.

F. Farm Machinery Management

Unit I Types of Selection

Types and sizes of tractors and equipment, factors involved in selecting tractors, size, power, costs, future needs, maintenance, repairs.

Unit II Estimating Power Requirements

Type of engine, horsepower ratings, matching implements, PTO output, drawbar requirements, hydraulic system output.

Unit III Estimating Fixed Costs

Fixed costs, operating costs, depreciation, taxes, insurance, shelter, records.

Unit IV Estimating Fuel and Lubricant Costs

Fuel types, fuel consumption, horsepower/hours capacity, cropping system requirements, lubricant costs, fuel saving tips.

Unit V Estimating Repair Costs

Types of repairs, life of equipment, routing repairs, "neglect" repairs, accidental repairs. Records.

Unit VI Total Costs for Machinery Operations

Combination of Units III, IV, and V, and introduction of records necessary to determine system costs.

Unit VII Measuring Machine and Field Capacity

Capacity measuring methods, acres per hour, tons per hour, measuring operating speed, width, production efficiency, math calculations.

Unit VIII Management Decisions

To buy used or new machinery, when to trade, calculating custom work costs, comparing ownership, leasing, and rental costs.

APPENDIX B

FARM POWER CURRICULUM EVALUATION FORM

Please complete the evaluation form for the Farm Power Curriculum Instructor's Guide. Use the following scale:
1=poor to 10=excellent.

Area	(Please Check One Box For Each Area)									
	1	2	3	4	5	6	7	8	9	10
Unit Subject Content										
Objective Sheets										
Instructor Guides										
Information Sheets										
Notes of Explanation										
Transparency Masters										
Assignment Sheets										
Job Sheets										
Test and Answers										
Ease of Adaptability										
Usefulness to your program										
Overall Unit Evaluation										

The specific goals of this project have been: (a) Search for and evaluate potential utilization of new and emerging technologies and curricula in farm power and equipment to improve and expand vocational agriculture programs in Arkansas. (b) Develop competency based criterion referenced curriculum materials for secondary vocational agriculture programs and to extend those competency based tasks for use in post-secondary settings. (c) Field test and evaluate the developed curriculum in diverse secondary and post-secondary settings. (d) Disseminate for statewide implementation a competency based criterion referenced curriculum guide to improve and expand the scope and quality of instruction in farm power and equipment.

How well do you feel each these project goals have been meet? Use the following scale: 1=poor to 10=excellent

	1	2	3	4	5	6	7	8	9	10
Objective (A)										
Objective (B)										
Objective (C)										
Objective (D)										

(over)

In your opinion, what could be done to enhance this Farm
Power Curriculum Guide?

Signature

School

Thank you for your help and cooperation on this project.

FARM EQUIPMENT CURRICULUM EVALUATION FORM

Please complete the evaluation form for the Farm Equipment Curriculum Instructor's Guide. Use the following scale:
1=Poor to 10=excellent.

(Please Check One
Box For Each Area)

Area	1	2	3	4	5	6	7	8	9	10
Unit Subject Content										
Objective Sheets										
Instructor Guides										
Information Sheets										
Notes of Explanation										
Transparency Masters										
Assignment Sheets										
Job Sheets										
Test and Answers										
Ease of Adaptability										
Usefulness to your program										
Overall Unit Evaluation										

The specific goals of this project have been: (a) Search for and evaluate potential utilization of new and emerging technologies and curricula in farm power and equipment to improve and expand vocational agriculture programs in Arkansas. (b) Develop competency based criterion referenced curriculum materials for secondary vocational agriculture programs and to extend those competency based tasks for use in post-secondary settings. (c) Field test and evaluate the developed curriculum in diverse secondary and post-secondary settings. (d) Disseminate for statewide implementation a competency based criterion referenced curriculum guide to improve and expand the scope and quality of instruction in farm power and equipment.

How well do you feel each of these project goals have been meet?
Use the following scale: 1=Poor to 10=excellent

	1	2	3	4	5	6	7	8	9	10
Objective (A)										
Objective (B)										
Objective (C)										
Objective (D)										

(over)

In your opinion, what could be done to enhance this Farm
Equipment Curriculum Guide?

Signature _____

School _____

Thank you for your help and cooperation on this project.